Australian Government
Department of Defence
Defence Science and
Technology Organisation

Sense Making in the Australian Defence Organisation (ADO) Intelligence Community

Mark Burnett, Pete Wooding and Paul Prekop*

Command and Control Division
Defence Science and Technology Organisation

*** Capability Development Group**
Australian Defence Headquarters
Canberra, ACT 2600

DSTO-GD-0440

ABSTRACT

This paper discusses sense making, and its role in how intelligence analysts understand and interpret events. The inherent limitations in the way an analyst, based on organisational and personal perspectives, understands the world is described and points toward the need for meta-sense making techniques. Insights from complex systems theory and knowledge management can be used to understand how techniques from these areas can be applied in practice, and assist in mitigating some of the risks due to the cognitive limitations inherent in intelligence processes. The relation of an augmented capability for sensing and understanding to emerging whole-of-enterprise concepts such as Sense and Respond and UC2 is also sketched.

Published by

DSTO *Defence Science and Technology Organisation*
PO Box 1500
Edinburgh South Australia 5111 Australia

Telephone: (08) 8259 5555
Fax: (08) 8259 6567

AR-013-446
July 2005

Sense Making in the Australian Defence Organisation (ADO) Intelligence Community

Executive Summary

Since the end of the Cold War estimative intelligence, in particular, has shifted from dealing with a knowable and reasonably well-defined objective reality to one in which reality is fundamentally complex, uncertain, and in some cases unknowable. Gaining the edge over an adversary now relies more on the *analytical*, *predictive* and *cognitive* abilities that can be brought to bear on the mass of information than on the *collection* of the information per se.

The organisations within the Australian Intelligence Community (AIC) are viewed as contexts for *sense making* of complex and uncertain environments. Sense making occurs in novel situations where there is a divergence between what is expected and what is observed. When dealing with these environments, the cognitive challenges facing analysts highlight the need for a good understanding within the AIC of the underlying mechanisms that allow for growth and contestability of knowledge in complex and uncertain areas.

It is argued that the way analysts understand the world is heavily influenced by their own and organisational perspectives. Complex systems theory can be used to gain new insights of real world events and our ability to understand them.

Core to improving the cognitive activity of intelligence analysis are tools for hypothesis testing and for "what-if" scenario testing, as is a better understanding of semantic computing and the use of service oriented architectures to support whole-of-enterprise information management.

Collaborative structures that relate to the formation of new patterns of perceptions, new ways of understanding the world, and the disruption of existing mind-sets are needed. Such structures seek to tap into *breadth* of knowledge in and beyond the ADO intelligence community to create an environment encouraging counter-intuitive insights.

Contents

1. INTRODUCTION 1

2. SENSE MAKING IN A COMPLEX WORLD 2
   2.1 Sense Making 2
   2.2 The Intelligence Conundrum 5
   2.3 Knowledge and Understanding 6
   2.4 Complexity 8
   2.5 Social Complexity 9
   2.6 Summary 11

3. IMPLICATIONS 13
   3.1 Tools for Thinking 14
   3.2 Implications for Community and Collaboration 15

4. THE MILITARY ENTERPRISE PERSPECTIVE 19

5. CONCLUSIONS 21

1. Introduction

Despite continuous improvements in the technology used to collect and process raw intelligence data, intelligence is still largely a cognitive activity – an activity rich in decision making, interpretation and perceptions. And while there have been considerable improvements in addressing the technological aspects of intelligence processing and gathering, there haven't been comparable improvements in addressing the fundamental cognitive challenges intelligence analysts face (Heuer 1999). Included among these cognitive issues are the following:

- The mind is poorly "wired" to deal effectively with many forms of uncertainty that surround complex, indeterminate intelligence issues and the "fog" associated with denial and deception operations;
- Increased awareness of cognitive and other "unmotivated" biases, such as the tendency to see information confirming an already-held judgment more vividly than one sees "disconfirming" information, does little by itself to help analysts deal effectively with uncertainty[1];
- Tools and techniques that gear the analyst's mind to apply higher levels of critical thinking can substantially improve analysis on complex issues for which information is incomplete, ambiguous, contradictory, and often deliberately distorted. Key examples of such intellectual devices include techniques for structuring information, challenging assumptions, and exploring alternative interpretations.

The goal of this paper is to explore the cognitive dimension of intelligence analysis, and in particular to provide a conceptual basis for understanding the cognitive dimension of intelligence processing and how these insights can be exploited for better intelligence assessments.

This paper discusses sense making, and its role in how intelligence analysts understand and interpret events. The inherent limitations in the way an analyst understands based on organisational and personal perspectives is described, pointing towards the need for meta-perception or meta-sense making techniques. Insights from complex systems theory and knowledge management can be used to understand how some of these techniques can be applied in practice, and assist in mitigating some of the risks due to the cognitive limitations inherent in the intelligence processes.

How these ideas fit into the broader military enterprise are also sketched, in particular the relation to adaptive operational planning and Command and Control.

---

[1] Paul Dibb [The Australian Newspaper, 24 Feb 04], when talking about the Australian intelligence relating to the search for WMD in Iraq before the 2003 invasion, makes the point that when judging hard issues intelligence agencies are prone to look for confirming rather than disconfirming evidence.

2. Sense Making in a Complex World

2.1 Sense Making

Sense making is a process that intelligence analysts and decision makers go through when dealing with complex problems involving ambiguous or poor information, changing circumstances and multiple players. Sense making is the process of finding the 'best' set of perceptions that helps to understand the problem/situation.

Much has been written about sense making recently[2]. For example Weick (1995) talks about a sense making mechanism with three elements – events or objects, a framework and a relation between them. In addition to placing items into frameworks, sense making is described in terms of comprehension and construction of meanings, and is contrasted by Weick with interpretation. From this viewpoint interpretation, loosely defined as an acceptable and approximate translation (usually of some sort of text), is a component of sense making. But sense making addresses how the text is constructed as well as how it is read. It often involves the collective application of intuition and largely "tacit" knowledge based on experience and expertise in a demanding, difficult or complex task. For instance Tovstiga et al. (2004) explore sense making and learning in a string quartet, and draw strong parallels between the quartet and complex organisations.

Within complex environments, we view sense making as a precursor to situation awareness (SA), and in many ways, as a driver of the process of SA. Endsley's definition of SA (Endsley 1995) – "Situation awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" – introduces and relates the three elements of SA: perception, comprehension and projection. A sense making framework can impact each of these elements – it can tell you what to look for as a precursor to perception, it impacts how perceived events or objects appear to relate to each other (known as situation assessment), and how these in turn project onto their potential or future effects in this or another arena (known as impact assessment).

Each of these SA elements affects the other in non-linear ways, and emphasises the need for a sense making framework, particularly when the stakes are high. An example is the events described in the film Fog Of War where Defense Secretary McNamara recounts an incident in 1964 when two US destroyers (the Maddox and the Turner Joy) appeared to have been attacked by torpedoes. A few days before this the Maddox, on an intelligence gathering operation in the Gulf, had been attacked by P-4 torpedo boats in a battle lasting 22 minutes, and this latest episode was assumed to be an intensification of hostilities to test the US's resolve to escalate the conflict to new levels.

---

[2] For instance a Command and Control Research Program Sensemaking symposium in 2001 (Leedom 2001) identified a greater need for understanding the foundations of sense making, particularly in light of new operating concepts such as EBO and NCW.

Figure 1 shows a simplified Endsley-type view of the incident put together by the authors.

	Situation Awareness	US Navy / Government
perception of elements in the environment	***Perception (Object Assessment)***	Aug 4 1964 Maddox and Turner Joy report torpedo attacks
representations of relations between elements	***Comprehension (Situation Assessment)***	North Vietnamese attack.
representations of effects of relations between elements	***Projection (Impact Assessment)***	Air attacks against N. Vietnam

Figure 1: An Endsley (situation awareness) representation of the Gulf of Tonkin incident, 1964

At the object assessment level there was some debate about whether the radar signals actually indicated attacking torpedo boats, but this was resolved in the affirmative, partly one suspects because it fitted with the previous incident. At the comprehension and projection levels there was agreement between the Pentagon and President Johnson that the US must respond quickly to avoid losing face. The end result was that the US Congress quickly passed the Gulf of Tonkin resolution that paved the way for a massive escalation in the war against Vietnam. It emerged that there were no torpedo boat attacks, but the mindset of the US military and policy makers did not allow for a critical examination of the initial evidence, and there was a lack of diversity in the military sense making apparatus to allow better assessments to be made.

Another, structurally different, example is in the Cuban Missile Crisis when the Soviet ship Grozny crossed the blockade imposed by the US Navy around Cuba (see Figure 2). Here the perception was spot-on – the ship had indeed crossed the blockade – but the comprehension and projection of this incident was very different for the Pentagon in the form of Admiral Anderson and the policy maker McNamara. Though each behaved rationally and professionally they had different sense making frameworks with which to process the underlying event information, and came up with different understandings of the action to take.

	Situation Awareness	Admiral Anderson	SEC McNamara
perception of elements in the environment	***Perception (Object Assessment)***	Grozny crossed blockade 2 hrs ago	Grozny crossed blockade 2 hrs ago
representations of relations between elements	***Comprehension (Situation Assessment)***	"We're going to follow the Rules of Engagement."	"This is not a blockade"
representations of effects of relations between elements	***Projection (Impact Assessment)***	Attack the Grozny	"This is President Kennedy communicating with Secretary Khruschev"

Figure 2: An Endsley (situation awareness) representation of a blockade incident in the Cuban Missile Crisis, 1962

The inclusion of acts – such as "Attack the Grozny" – in these diagrams is, strictly speaking, outside of Endsley's cognitive model of situation awareness. It could also be argued that, from the perspective of the Commander of one of the ships in the Gulf of Tonkin, the "tracks" on the radar screen are at the perception (object) level, leading through to an impact assessment that the ship's anti-patrol boat defences need to be heightened. This indicates that SA is highly subject dependent, and the figures represent a conflation of the SA of a number of key players in the incidents.

It is also possible to represent[3] these incidents using the other main abstractions of military decision-making, namely Boyd's OODA loop and Klein's RPD (Recognition-Primed Decision) model (Klein 1993), which include decision and (for OODA) action phases. In complex situations Conklin (2004) believes that the cognitive processes of sensing, understanding, deciding and acting (or their equivalents in the major models) are not performed linearly. To use a mechanistic analogy, there are feed forward and feedback loops, and processes going on in parallel and apparently out of order that are not represented in these simple models. Lambert and Scholz (2005) discuss in detail how the ADF JMAP (Joint Military Appreciation Process), which is based on OODA, departs in practice from the linear model.

[3] And it is possible to inter-relate all three models – see Rousseau and Breton 2005.

2.2 The Intelligence Conundrum

The point to be made here is that whatever model is assumed, for complex or uncertain environments sense making is an implicit and organic part of the process that ascribes meaning to perceived sensations. This paper attempts to open up some of the mechanisms for sense making of complex issues at an enterprise level for the intelligence community.

In dealing with multi-faceted and complex issues analysts have always been challenged in providing sound and timely advice. Estimative intelligence, which is concerned with what might be or what might happen, has increased in difficulty and changed in nature since the end of the Cold War where intelligence knew the problem and could envisage a reality it was seeking to comprehend. Joseph Nye's phrase "Mysteries Not Puzzles" (Nye 1994) reflects the mind shift from a knowable objective reality to one in which reality is fundamentally complex, uncertain, and in some cases unknowable[4].

The Australian intelligence enterprise is no different. The growth in the *multiplicity, diversity and type of security threats facing Australia* point toward the need for greater adaptability and innovation from the intelligence enterprise in meeting these threats. And, as a consequence of the information technology revolution over the last 20 years, the *breadth and depth of data* to be considered has expanded enormously, and will continue to expand. Access to technology such as high-speed communication links, encryption and powerful computers is becoming ubiquitous and having these no longer provides a clear operational edge for the community. The *depth of knowledge/expertise* required to analyse, anticipate and understand complex, multi-variate problems has also grown considerably. The edge over an adversary is now more in the *analytical*, *predictive* and *cognitive* abilities that can be brought to bear on the mass of information than on the *collection* of the information per se. This has important capability implications for developing a *balance* between sensing (capacity to observe) and sense making (capacity to orientate) in the context of the ADO's migration towards network-enabled operations.

A key to sense making is attempting to appreciate the understanding that humans bring to the process, and the way in which that understanding is used, shared, tested and evolved during the process. How sense making occurs, and how understanding is used, is strongly dependent on how we think and how we represent the world. This is

---

[4] There is a critical distinction between what may be called *conventional* threats and *emerging* threats. [ref: Robert Steele, On Intelligence – Spies and Secrecy in an Open World, OSS, 2001, quoting from Gen. Alfred Gray, Commandant of the Marine Corps., Global Intelligence Challenges in the 1990's, American Intelligence Journal 1989-1990] Conventional threats are associated with static orders of battle, linear development and deployment capabilities, and well-understood rules of engagement and doctrine. The emerging threat, in contrast, is non-governmental, non-conventional, dynamic or random, and non-linear with no constraints or predictable doctrine.

the territory of philosophy, and constitutes a framework or methodology in which knowledge can be used.

2.3 Knowledge and Understanding

A dictionary definition of understanding is "the faculty of thinking, reasoning, and acquiring and applying knowledge". It often relates to having cognisance of a comprehensive, interrelated system that can be used for prediction of the future states of a system, explanation as to why the system behaves in the way it does, and how different knowledge relating to it fits together. However, an expert juggler who can adapt to different objects to juggle or different partners to juggle with might be said to understand juggling, though the knowledge on which this is based is largely tacit and based much more on experience than any model, system or theory. They might, for instance, find it difficult to explain how to juggle. This leads to a somewhat broader view of understanding as the ability to successfully apply and acquire knowledge for new contexts.

How knowledge is defined determines how it is managed, so it is important to have a clear definition. And the terms knowledge and information are so broad that they become meaningless unless given clear definition. For the purposes of exploring the role that knowledge plays in sense making we adopt the following definition:

> "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms" (Davenport and Prusak 1997).

This definition ties knowledge closely to cognition and argues that knowledge is a dynamic, conceptual and largely human process of organising, re-organising and making sense of information, experiences, and events (Nitecki 1985). In this view, knowledge is not a "thing" or a system, but an ephemeral, *active cognitive process of relating* (Stacey 1992) the external world and external events to what is already known.

Some knowledge can be made explicit, and codified as information. A key characteristic of this type of knowledge is that it can be disembodied from its knower or originator. Since this type of knowledge can be encoded as information and can be disembodied from its creator, it can be shared as words, pictures, e-mails, web pages, text guides, instruction manuals, and so on, and can be held in forms that can be duplicated, shared, or stored in a computer system. Managing this kind of explicit knowledge is the realm of information management methods and information management technology.

In contrast to explicit knowledge, *tacit* knowledge is the intangible, internal, and intuitive knowledge in the human mind. By its very nature, it is very difficult to make tacit knowledge explicit (Polanyi 1966). Tacit knowledge has to do with insight, understanding, experience, capability, skill and expertise. This kind of knowledge can be shared through an ongoing interaction between the holder (the knower) and the receiver of the knowledge.

This distinction between tacit and explicit knowledge is important for the intelligence community because the types of knowledge important for sense making – expertise, insight, experiences, highly refined analytical skill – are likely to be tacit and hence impossible to disembody from the individual members of the intelligence community who hold them. This has significant implications for developing a knowledge-centric capability within the intelligence enterprise; this re-focusing has considerable consequences for organisation and culture beyond the present emphasis on information technology.

One of the great myths of knowledge management is that knowledge of this type can be readily converted into information, and is thus open to exploitation by information management techniques. By definition, however, tacit knowledge cannot be converted directly to explicit. And in the intelligence domain in particular, knowledge in support of decision-superiority is very context-specific. This makes knowledge difficult if not impossible to articulate without being prompted by a specific need (McDermott 1999).

Figure 3 shows our conceptualisation of the relation between knowledge, context, information and data to sense making. Note that this differs from the standard data-information-knowledge-wisdom pyramid often cited in the knowledge management literature.

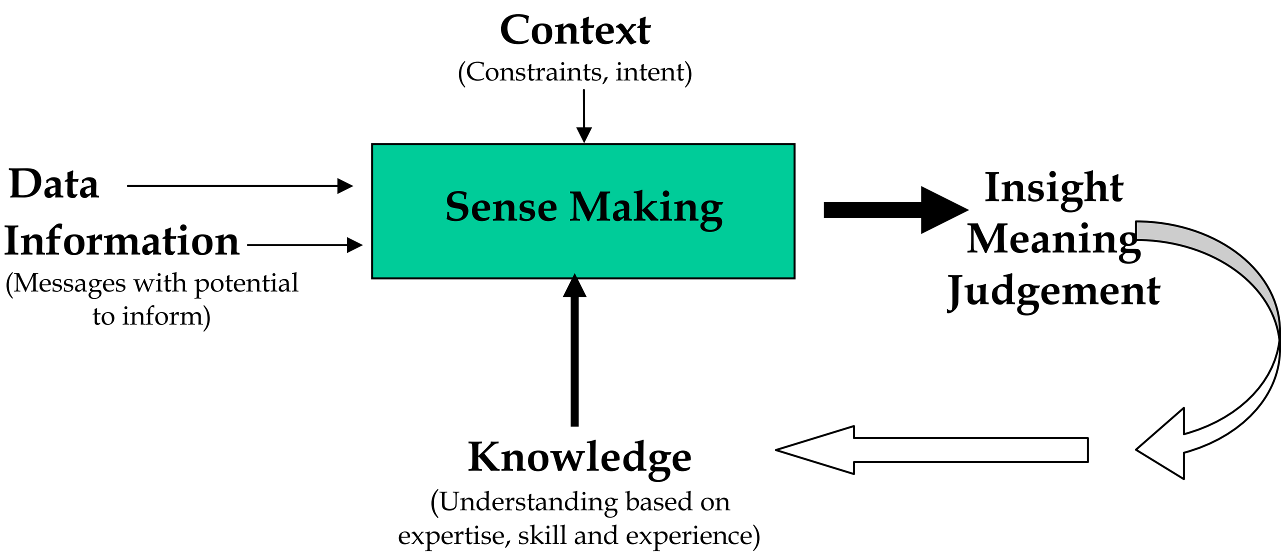

Figure 3: A schematic relating knowledge, context, information and data to sense making

The first part of Davenport and Prusak's (1997) definition focuses on knowledge as something that resides within the mind of the knower and as a framework for comprehension. When we talk about *knowledge* in this paper this is what we are referring to. Since knowledge (by this definition) is in the mind of the knower, knowledge within the intelligence community exists within the individual members of the intelligence community. It is their mix of experiences, values, analytical skills, and expert insights that provide the intelligence community the means of understanding, interpreting, and exploiting the information it collects to produce intelligence products.

As well as being what we know, knowledge also acts as a framework for evaluating and incorporating new experiences and information (Davenport and Prusak 1997). In essence, we use our existing knowledge to create our new knowledge. New events, experiences, and information are filtered through the results of past thinking, patterns of interpretation, implicit assumptions, and beliefs that have been learnt and built from experience, past thinking and reflection (Snowden 2002).

For the intelligence community, filtering new experiences and information through existing patterns of interpretation, implicit assumptions, and beliefs has two very significant effects. First, it affects how the intelligence community interprets the information it collects; it underpins an analyst's interpretation of current events, predictions and assessments of future events. Second, it influences what is considered important, relevant and worthy of consideration within the intelligence domain. In essence, *it drives where the intelligence community looks for potential problems or events of interest, and how it comprehends them in context.*

As a result, it is critical to recognise that the knowledge important to the intelligence community – the expertise, insight, experiences, highly refined analytical skill – cannot be easily codified, and cannot be shared as information. As a consequence, the key to making the knowledge resident in the intelligence community more productive is to provide a sound methodology for thinking and to place greater emphasis on the relationships and networks between staff to enable knowledge to grow, be tested and used most effectively.

2.4 Complexity

In recent years the cross-disciplinary subject of Complexity Science has opened up new understanding in many fields such as economics, biology, physics and computer science. A Complex System is any system that involves a large number of dynamically interacting elements[5]. These go through processes of change that are not describable by a single rule nor are reducible to only one level of explanation; these levels often include features whose emergence cannot be predicted from their current

[5] A complex system is differentiated from a *complicated* system such as an aircraft that can be de-composed into a number of sub-systems with known components, relationships and function.

specifications. The field of Complexity Theory attempts to apply scientific methods to these complex systems, concentrating more on the interactions and dynamics of the system than the elements themselves.

The science of complexity takes two phenomena as its foundation:

- There is non-proportionality in complex systems because small changes can have large consequences.
- There is non-additivity because the whole is more than the sum of its parts.

The dominant paradigm of complexity science is one of non-linearity. In contrast much of traditional science deals with linear systems where changes in the system input result in proportional changes in the output (linearity), the whole is the sum of its parts (proportionality), the system may be understood by observing the behaviour of its individual parts (reductionism), and the system has processes that flow along orderly and predictable paths with clear beginnings and rational ends (determinism).

For the intelligence community sense making increasingly involves dealing with, and gaining some workable understanding of, inherently *complex,* adaptive and interlinked systems, such as social and military organisations, economies and public opinion. Cause and effect linkages are not inherently knowable in such systems, and *order* tends to be an emergent property of the system rather than a fundamental one. *Sense making is the process of choosing the right set of perceptions and mental models to be able to understand and act successfully in this type of environment.*

2.5 Social Complexity

Snowden (2005) contrasts the complexity of the systems modelled mathematically by Complexity Science pioneers such as Axelrod, Kauffman et al. (see for example Kauffman 1996) with the complexity of human systems. Snowden lists the unique aspects of human systems as follows:

- Humans make decisions based on patterns
- Humans create and maintain multiple identities
- Humans ascribe intentionality and cause where none necessarily exists
- Humans have learnt how to structure their social interactions to create order

The Cynefin framework (Kurtz and Snowden 2003) takes a social complexity-based approach to knowledge management and sense making. It maps out four domains of organisational knowledge (as shown in Figure 4) over two broad areas – order (RHS of diagram) and un-order (LHS).

The *ordered* domain is characterised by complicated (but not complex) systems with a definite known or knowable order, and cause and effect relations that can be studied and discovered. It is further sub-divided into empirically *knowable* (the realm of

science, the expert and good practice) and *known* (the realm of bureaucracy, rules, procedures and best practice).

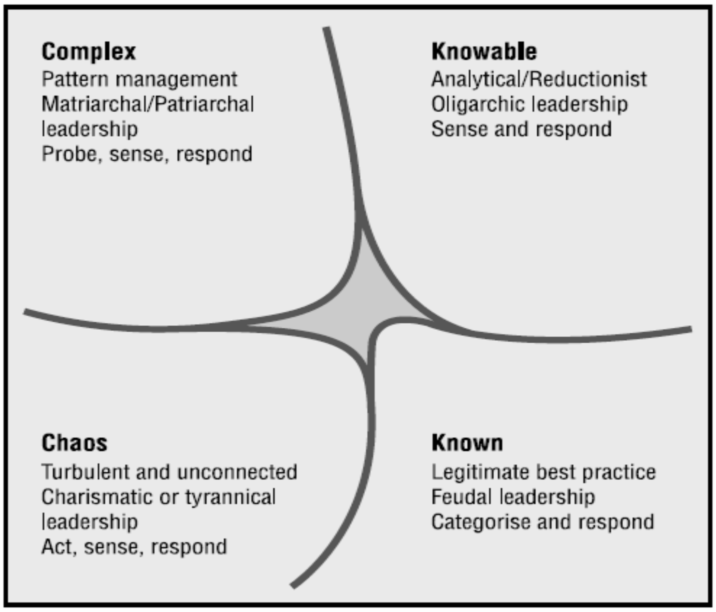

Figure 4: Cynefin Framework

In contrast sense making in the *un-ordered* domain recognises the inherent complexity of most things and that cause and effect cannot be discovered because they are so closely intertwined. The word un-order does not mean a lack of order, it means a different kind of order, one that is in contrast to ordered-systems thinking. Ordered-systems thinking assumes that through study and analysis we can discover empirically verifiable general rules or hypotheses that create a body of reliable and enduring knowledge. The domain of un-order has the characteristics of complex, adaptive systems; here the whole is never the sum of the parts, end points are highly path dependent, and cause and effect can be made out often only in retrospect.

In the ordered domain the conditions for the emergence of meaning are rationalist and reductive; the processes involve *sense and respond* for the knowable and *categorise and respond* for the known. In the un-ordered domain new science and new approaches are required to facilitate the use of knowledge and the emergence of meaning. Stacey (1992) develops this perspective by drawing on complexity sciences as the field for analogies with human action. This alternative perspective places self-organising interaction at the centre of the knowledge creating process in organisations.

It can be argued that the intelligence community is a product of an *ordered-domain* view of the world that is suited to the types of threats and the intelligence environment prevalent in the latter half of the last century. With well-defined threats and a focus on collection and technical expertise, the community naturally aligned itself with the

ordered model that permits exploitation of resources within the community for decision-makers faced with well-defined and relatively slow-moving threats.

The necessary entrainment of thought that characterises experts and expertise within say a military, technical or scientific community is ideal for exploitation of the knowledge in that community. But this characteristic makes it unsuited to exploring outside that space for innovative solutions and ideas. The empirically known and knowable domains are of crucial importance in *exploiting* the knowledge of the intelligence community, but they need to be supplemented and fed by new *exploratory* ways of making sense of the world that are not tied to existing mental models and paradigms based on order, process, consensus and best practice.

Dealing with the apparent duality of the problem space will require a shift in institutional thinking that appears problematic, but once made will reveal gains and benefits. In this sense, we contend that much of the extant intelligence procedures, doctrine, processes and products are a part of ordered-domain thinking, and as such need to be *complemented* – not replaced – by ideas, mental-models, techniques and tools, informed by the un-ordered domain of sense-making.

Applying ordered-space thinking to inherently un-ordered domains is a recipe for failure. Stewart (2002) describes a group of marines taken to the New York Mercantile Exchange in 1995 to be taught and to play with simulators of the trading environment. Naturally the traders won each time. But when the traders visited the Marine Corp's base in Quantico and played war games against the marines, they won yet again. What they realised is that the traders were skilled at comprehending patterns and intervening to favorably exploit those patterns. The Marines, on the other hand, like most business school graduates, had been trained to collect and analyse data and then make rational decisions. In a dynamic and constantly changing environment, it is possible to achieve some degree of comprehension of un-order but not to assume order[6].

2.6 Summary

Table 1 characterises the space of sense making by comparing and contrasting two approaches to sense making, based around the main concepts referenced in this paper – knowledge, and sense making in complex environments.

---

[6] In another experiment a group of West Point graduates was asked to manage the playtime of a kindergarten as a final year assignment. The cruel thing is that they were given time to prepare. They planned; they rationally identified objectives; they determined backup and response plans. They then tried to "order" children's play based on rational design principles, and, in consequence, achieved chaos. They then observed what teachers do. Experienced teachers allow a degree of freedom at the start of the session, then intervene to stabilise desirable patterns and destabilise undesirable ones; and, when they are very clever, they seed the space so that the patterns they want are more likely to emerge.

Table 1: Old and New Sense Making

"Old" Sense Making	**"New" Sense Making**
Based on 19th century physics (equilibrium, stability, deterministic dynamics)	Based on biological metaphors (structure, patterns, self-organisation, life cycle)
Sees the world as orderly, predictable and well-understood	Sees the world as complex, unpredictable and poorly understood
Knowledge can be codified, centralised and managed	Knowledge resides largely in the minds of people
Information is key to better sense making	Knowledge is key to better sense making
Sense making occurs within a well-defined organisational hierarchy	Sense making occurs across and beyond defined organisational boundaries
Teams actively seek confirmation of their views	Teams actively seek refutation of their views and a diversity of views
Key enabler is networking of IT systems	Key enabler is networking of people and software agent systems

3. Implications

A key implication for the intelligence community is that any view of reality is likely to be coloured and influenced, to a greater or lesser degree, by individual or organisational perceptions – their existing patterns of interpretation, implicit assumptions, and beliefs. As a result, intelligence products that attempt to describe and represent real world events and situations are inherently (and generally unintentionally) coloured by the individual or organisation that produces them.

For intelligence production, this means:

- All intelligence analysis is biased by the individual analyst's or organisation's perception and their existing patterns of interpretation, implicit assumptions, and beliefs. No intelligence analysis of a complex issue, then, can ever be free of this bias;
- What an analyst or an intelligence organisation considers important, relevant and worthy of consideration within the intelligence domain is also subject to the same bias, as a result identifying new or unexpected (relative to the analysis or the organisation's past experiences) threats, situations, or events is very difficult. They simply may not be seen;
- All information is interpreted by what is already known. Analysts and intelligence organisations don't deliberately look for information to refute or contradict what is already known. If they incidentally discover contradictory information, it may simply be ignored (Heuer 1999); and
- Analysts require a commitment to challenge, refine and challenge again their working hypotheses and assumptions.

For consumers of intelligence products, this means:

- Intelligence products are not objective facts, but high quality conjecture and opinion describing events; and
- Intelligence products are ultimately created within a context. This context includes the analyst's or organisation's intention for the use of the product, and the assumptions, world view, patterns of thinking, and so on, that all underpin the product. As a result, to truly understand intelligence the context in which it was created needs to be understood.

The Flood Report (Flood 2004, Chapter 6) deals in detail with the need for contestability of assessments. "For Australia to have the highest quality assessment, analysts need to be challenged, confronted by different perspectives, and alerted to flaws in their arguments" (Flood p. 84). The means for achieving contestability are outlined at a high level in the report, including the need for contestability between DIO and ONA. However, a conceptual basis for sense making is also needed in this regard,

along with informed advice on how this approach impacts intelligence practice and doctrine.

The next two sections discuss the implications of these ideas in terms of the tools and organisational structures employed within the intelligence community. Together they can be seen as part of an ongoing organisational process of mindfulness towards analytic failure (and success) and as a hedge against institutionalised ways of thinking and modes of behaviour.

3.1 Tools for Thinking

Much of the current focus in the intelligence capability development domain is on improved information management; this has produced an emphasis on data search/retrieval, pattern analysis and visualisation technologies. However, future development of *cognitive support tools* to add knowledge exploitation and sense making within the intelligence domain must go further and will need to encompass:

- *Hypothesis testing and "what-if" scenario testing tools.* These tools allow analysts to explore and test out different hypotheses and theories about the world to challenge assumptions and explore alternative interpretations. As an example Pope and Jøsang (2005) have recently developed a formal approach to the evaluation of competing hypotheses, based on a calculus known as Subjective Logic, that allows for integration of empirical and statistical data as well as for judgments made by analysts.

- *Sophisticated applications that allow analysts to fully explore the data used in sense making.* Although pattern/trend analysis has been the traditional realm of intelligence applications, future developments need to migrate from merely identifying patterns/trends to enabling analysts to better *comprehend* patterns in their data, build mental models of their data, and to structure and re-structure their data. These would include sophisticated data/information query tools and data/information visualisation tools which could employ expert systems, artificial neural networks and machine learning technologies.

As well as tools to support the production of intelligence, apparatus to capture and embed the context that surrounds the intelligence product is also needed. These tools allow the creators of intelligence products to include the processes, assumptions, and world views used to create the intelligence. These same descriptions can be used by the consumers of intelligence products to build a richer understanding of the intelligence products they are using.

While the focus of this paper is on the largely human capabilities involved in sense making, it is worth pointing out in this section the need for information systems that underpin the types of cognitive support tools under discussion. There is a clear need for a whole-of-enterprise approach to managing and using information that is all too

frequently locked away in stove-piped applications that make it difficult to share data with other systems. In addition the ownership and control of these applications is often within one agency making sharing and access across organisational boundaries problematic. While reliable and secure access to data is improving, it is in the logical description and transformation of information – not just its transport – that the main barriers to enterprise-wide use of information exist. As stated in the US Government Semantic Interoperability Community of Practice white paper (SICoP 2005):

> "The goal is not just to connect systems, but also to make the data and information resident within these systems interoperable and accessible for both machine processing and human understanding. "

Computing initiatives such as the Semantic Web[7] offer a way ahead in this regard as do, in the shorter term, the Service Orientated Architecture (SOA) approach to managing and using complex information environments (see for example http://www.service-architecture.com/). Web Services are an implementation of the SOA based around commonly used internet protocols such as HTTP and data definition languages such as XML. They provide a practical, open, standards-based approach to whole-of-enterprise information management.

In the longer term one goal for the intelligence community is to spend less time finding information and more time analysing it. More advanced software including "intelligent" agents that use a semantic computing infrastructure will help to automate a lot of the drudge work of information gathering, and will play a part in this vision.

3.2 Implications for Community and Collaboration

Underlying patterns of interpretation, implicit assumptions, and beliefs can be a major problem for the manufacture of intelligence products if they are not recognised and managed. However, when combined, several different views of reality are likely to be a closer approximation to reality then a single view; exploited in this way, such a range of views can be a major asset for the manufacture of intelligence products. Providing organisational structures and toolsets that assist in reconciling and generating different views may be seen as constituting a powerful form of risk management for the ADO intelligence community.

Key to supporting peer review is providing opportunities, structures and technology that allow individual analysts to interact with each other, sharing their underlying theories and ideas and examining and testing out each other's theories and ideas.

To do this the intelligence community requires an environment where different views are encouraged, and exploited to produce full, multifaceted analysis. In such an

---

[7] See The World Wide Web Consortium's Semantic Web Activity page:
<http://www.w3.org/2001/sw>/

environment there are organisational structures that support collaboration across group and organisational boundaries[8].

Cynefin's multi-ontology sense making framework (Snowden 2005) discusses a means of achieving a requisite level of diversity in both the ways we interpret the world and the way we act in it. Requisite diversity means ensuring the acceptance of a sufficient level of divergence to enable the sensing of weak signals (terrorist threat or operational opportunity) and avoidance of pattern entrainment of past success, while maintaining a sufficient focus to enable decisive and appropriate action.

In this respect there are two important types of collaborative networks:

Community of Practice. Having experts in particular areas within the community, whether that area is a country, a religion, or a terrorist organisation, is crucial to the quality of intelligence produced by the community. The *Community of Practice* (CoP) is centred on a well-defined domain of knowledge and expertise; it taps into *depth* of specialist knowledge reflecting an environment of 'conventional wisdom'. The members of the community share a common set of patterns of interpretation, implicit assumptions, and beliefs.

The goal of the community is to create, maintain, and share its knowledge within a well-defined domain. These communities can be informal or formally structured, and are typically long-lived in comparison to task or team oriented groupings. All members can equally share the community's knowledge, and equally add to the community's knowledge through their work and experiences. These kinds of communities also perform the role of enculturation of new members into the knowledge of the community – passing on the facts, methods, information, the lore, the language, and the ways of thinking that are a part of the community (Wenger 1998). This can be seen as an ordered domain process that incrementally grows and maintains knowledge. It roughly maps onto the top right of the sense making domains of Table 2.

Exploration Network (EN). Increasingly important, this relates to the formation of new patterns of perceptions, new ways of understanding the world, the disruption of existing beliefs and ultimately innovation across the entire enterprise. In effect it seeks to tap into *breadth* of knowledge to create an environment encouraging counter-intuitive insight.

An example of an exploration network is a (generally informal) assemblage of friends, associates and colleagues drawn from inside and outside the functional

---

[8] These communities are supported by technology such as basic tools to support collaboration across time and space. These include: communications tools (e-mail, instant messaging and so on); tools to support sharing of information; and tools and processes that allow individuals to discover each other, and to build working relationships with each other.

groupings of task and organisation. Membership of these kinds of communities is loosely defined, with members having similar or very different patterns of interpretation, assumptions, and beliefs. Potentially these networks can work at the edges of what is known where existing patterns of interpretation, implicit assumptions and beliefs fail. We argue that these networks need to be recognised, cultivated and exploited by the intelligence enterprise. The exploration network grows new patterns of perception that may be exploited within the rest of the intelligence community, and roughly maps onto the top left of Figure 1.

Surowiecki (2004) argues compellingly that in many situations involving cognition, a group of people is smarter than the smartest people in that group. Examples of collective intelligence include:

- The group average estimate of the number of jellybeans in a jar almost always is more accurate than the best individual guess.
- In TV game shows the collective audience answers often do better than those of a chosen "expert".

According to Surowiecki, collective intelligence relies on:

- Diversity of view within the group
- Independence of agents within the group
- De-centralisation of the group
- A means for aggregating opinions

The similarity between this type of group and the exploration network described above is striking. The necessary facets of collective intelligence identified by Surowiecki allow the intelligence community to construct these networks as part of their cognitive toolkit, though the issue of security needs to be risk managed.

The exploration and CoP networks are compared and contrasted in Table 2. These networks serve different purposes and have different sense making methodologies and approaches. For the intelligence community the CoP helps to maintain and build deep knowledge in a particular area or domain. The EN is designed to generate new conjectures and confront existing ideas and conceptualisations.

One of the big challenges here is management of this type of network[9]. The intelligence community needs to be able to tap into the knowledge of its various agencies, wider Governmental departments and into the diverse Australian public for alternate viewpoints and theories. Finding people in the wider community who act as bridges between sub-networks or localised groupings is important, as is finding techniques that facilitate learning and innovation around these networks.

Critical to the development of an exploration network to complement existing and well-established CoPs is exploiting the growing field of social network analysis (SNA).

[9] In contrast to a CoP where membership is reasonably well-defined based on professional, technical or organisational duties, in an EN participation in the network is much more uncertain and diverse. In fact diversity of view and opinion, serendipitous encounters and a bottom-up organisational structure are seen as important elements of an EN.

This discipline provides an important scientific basis for comprehending the nature of collaboration within the multi-dimensional network that is the intelligence community as well as the multiple interdependent ways of being connected. In this respect, affiliation networks and the existence of the small-world phenomenon[10] provides a potentially useful mechanism for extending the connectedness and reach of the intelligence enterprise. This aspect of collaboration warrants further research, especially given the migration towards a network centric focus for the Australian Defence Organisation.

Table 2: Community of Practice and Exploration Network characteristics

Community of Practice	**Exploration Network**
Specialised terminology	Everyday language
High levels of abstraction	Low levels of abstraction
Shared practice and domain of interest	Shared experiences, values and beliefs.
Well-defined practice within the domain – the set of frameworks, tools, information, language and documents that the community shares	The development of a practice is a possible, long-term outcome of exploration, not a given
Well-defined areas of common interest (the domain of the CoP)	Often poorly defined areas of common interest
Long-lived, relatively static membership	Short-lived, dynamic associations
Community members defined by professional or organisational groupings	Networks form and re-form depending on task and need
Goal is incremental improvement in applying knowledge in a well-defined area	Goal is to develop new interpretations, conjectures, ideas and ways of looking at the world that may be exploited for a purpose
Examples include guilds, scientists within a field, technical repair staff, software engineers, and intelligence experts in a particular field	Examples include heterogeneous work units such as Tiger Teams, and social networks such as Community Action Groups

[10] This is the widely reported finding that though there are 6 billion people on Earth, there are no more than 6 degrees of separation between any two of them.

4. The Military Enterprise Perspective

This section places the ideas of the foregoing sections into a wider framework and looks at how sense making fits into the future military enterprise on a broader scale, by drawing on Haeckel's Sense and Respond strategy and Lambert and Scholz's UC2 framework (Lambert and Scholz 2005).

Haeckel formulates a response to a world of increasingly rapid and unpredictable change in *Adaptive Enterprise* (1999). He writes in the Introduction:

> "The only kind of strategy that makes sense in the face of un-predictable change is a strategy to become adaptive."

Adaptive Enterprise outlines the systematic means by which large, complex organisations can successfully adapt to change. Though written from a business perspective the ideas have relevance to the ADO. The vision of moving from a *plan* to produce specific offerings for specific markets to a *structure* for sensing and responding to change faster than the competition has resonance for military operations where the customer is often an adversary, and where a *plan* for action is better expressed, particularly in complex environments, as an adaptive *design* for action.

Renaming Boyd's OODA loop as the adaptive SIDA (Sense, Interpret, Decide, Act) loop, Haeckel identifies the first two elements collectively with *Sensing*, and the last two with *Responding*. Much of the sense making discussion in the previous sections fits into to the Sensing portion of the decision loop and raises the question of how it relates more generally to the adaptive enterprise.

In the systems approach to adaptivity outlined by Haeckel[11] there are five core enterprise competencies:

- Knowing earlier (Sensing and Interpreting)
- Managing by Wire (Augmented Sensing and Responding)
- Designing an organisation as a system (Strategic Context)
- Dispatching capabilities from the customer request back (Tactical Coordination)
- Leadership by Context and Coordination

Many of the enablers of better sense making outlined in Section 3 can be viewed as means to "know earlier" – by improving the peripheral vision of the enterprise, allowing weak signals to be interpreted and used as a basis for understanding and action. The UC2 framework, under an aegis focussed on "achievable intent through unity with diversity", provides an outline of many of the other core competencies for the ADF as it moves towards Network Centric Warfare. In particular it addresses the design requirements of an adaptive ADF by looking at capability development through

[11] See http://www.thefutureofgrowth.nl/downloads/Report%20IBM%20Seminar%20Adaptive%20Enterprise.pdf

a model of partial design contracting, and discusses how Command and Control is better characterised by coordination of multiple agencies (including subordinate military commanders and their staff) to make good and mutually coherent local decisions within the context of an overall intent.

Of particular interest is the “agreement network” that underpins the UC2 concepts. If the EN and CoP networks introduced in Section 3.2 are part of the “Sensing” apparatus, then this network can be viewed as part of the “Respond”. For an operational mission, the agreement network is a dynamic association of agent capabilities, which include software systems as well as people and equipment, brought together to achieve a purpose on the basis of the competencies and roles of the agents involved. Mission agreement is facilitated with social coordination protocols that encapsulate the roles and accountabilities of these dynamic societies.

5. Conclusions

Since the end of the Cold War estimative intelligence in particular has shifted from dealing with what was often assumed to be a knowable and reasonably well-defined and well-understood objective reality to one in which reality is fundamentally complex, uncertain, and may not be not fully understandable. The edge over an adversary is now more in the analytical, predictive and cognitive abilities that can be brought to bear on the mass of information than on the collection of the information. This has important capability implications for developing a balance between sensing (capacity to observe) and sense making (capacity to orientate) in the context of the ADO's migration towards network-enabled operations.

This paper has argued that intelligence is a cognitive activity, and that sense making is a powerful way of conceptualising the cognitive activities performed by intelligence analysts.

Within this view of the intelligence activity, intelligence generated from sense making is informed conjecture. This raises a number of implications for the crucial human collaborative networks that support this process and the systems that supply information to it.

Core to improving the cognitive activity of intelligence analysis are tools for conjecture testing and analysis, and, in the longer-term, machines that are capable of understanding the meaning of information they have access to.

Collaborative structures that relate to the formation of new patterns of perceptions, new ways of understanding the world, and the disruption of existing mind-sets are needed. Such structures seek to tap into *breadth* of knowledge in and beyond the ADO intelligence community to create an environment encouraging counter-intuitive insights.

The relation of an augmented capability for sensing and understanding to emerging whole-of-enterprise concepts such as Sense and Respond and UC2 is worthy of more detailed consideration.

References

Breton, R. and Rousseau, R. (2005), "*The C-OODA: A Cognitive Version Of The OODA Loop To Represent C2 Activities"*. 10th CCRTS: The Future of Command and Control.

Conklin, J., (2004). *Dialog Mapping: Making Sense of Project Fragmentation*, Chapter 2. forthcoming. See: http://www.cognexus.org

Davenport, T. H. and L. Prusak (1997). *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press.

Endsley, M. (1995). Toward a theory of situation awareness in dynamic systems, Human Factors, 37(1), 32-64

Flood, P (2004). Report of the Inquiry into Australian Intelligence Agencies, Australian Government Publication, Online at http://www.pmc.gov.au/publications/intelligence_inquiry/docs/intelligence_report.pdf.

Haeckel, S. H. (1999). *Adaptive Enterprise: Creating and Leading Sense-and-Respond Organizations*, Harvard Business School Press.

Heuer, R. J. (1999). Psychology of Intelligence Analysis. Washington, DC, Center for the Study of Intelligence, Central Intelligence Agency.

Kauffman, S (1996). *At Home in the Universe: The Search for Laws of Self-Organization and Complexity*, Oxford University Press.

Klein, G. A. (1993). *A recognition-primed Decision (RPD) model of rapid decision making*. In G. Klein, J. Orasanu, R. Calderwood, & C.E. Zsambok (Eds), Decision making in action: Models, and methods (pp. 138-147). Norwood, NJ: Ablex.

Kurtz, C. F. and D. J. Snowden (2003). "*The new dynamics of strategy: Sense-making in a complex and complicated world*." IBM Systems Journal **42**(3).

Lambert, D. and Scholz, J. (2005). "*A Dialectic for Network Centric Warfare,* " 10th CCRTS: The Future of Command and Control.

Leedom, D. (2001). Sensemaking Symposium. Command and Control Research Program. Online at www.dodccrp.org/events/2001/sensemaking_symposium/docs/FinalReport/Sensemaking_Final_Report.pdf

McDermott, R. (1999). "*Learning Across Teams: How to build communities of practice in team organisations*." Knowledge Management Review **May/June**(8).

Nitecki, J. (1985). "*The concept of information-knowledge continuum: implications for librarianship*." Journal of Library History **20**(4): 387-407.

Nye, J. (1994). "Peering into the Future." Foreign Affairs **73**(4).

Polanyi, M. (1966). *The Tacit Dimension*. London, Routledge & Kegan Paul Ltd.

Pope, S. and Jøsang, A. (2005), *Analysis of Competing Hypotheses using Subjective Logic*, 10th CCRTS: The Future of Command and Control

Snowden, D. (2002). "*Complex acts of knowing: paradox and descriptive self-awareness*." Journal of Knowledge Management **6**(2).

Snowden, D. (2005). "*Multi-ontology sense making: a new simplicity in decision making*". Management Today, Yearbook 2005, Vol 20

SICoP, (2005). " *Introducing Semantic Technologies and the Vision of the Semantic Web*" KM.GOV White Paper, editor: Fromm, K.

Stacey, R. D. (1992). *Managing the Unknowable: Strategic Boundaries Between Order and Chaos in Organizations*, Jossey-Bass.

Stewart, T. A. (2002). *How To Think With Your Gut*. Business 2.0.

Surowiecki, J. (2004). *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, Doubleday.

Tovstiga, G., Odenthal, S. and Goerner S. (2004), *Sense-Making And Learning In Complex Organizations: The String Quartet Revisited,* The Fifth European Conference on Organizational Knowledge, Learning and Capabilities, Innsbruck, Austria, April 2-3, 2004

Weick, K. E. (1995). Sensemaking in Organizations, Sage Publications.

Wenger, E. (1998). "*Communities of Practice: Learning as A Social System*." Systems Thinker.

DISTRIBUTION LIST

Sense Making in the ADO Intelligence Community

Mark Burnett, Pete Wooding and Paul Prekop

AUSTRALIA

DEFENCE ORGANISATION

	No. of copies
Task Sponsor	
Deputy Chief Defence Scientist Policy	**1 printed**
S&T Program	
Chief Defence Scientist	1
Deputy Chief Defence Scientist Policy	1
AS Science Corporate Management	1
Director General Science Policy Development	1
Counsellor Defence Science, London	Doc Data Sheet
Counsellor Defence Science, Washington	Doc Data Sheet
Scientific Adviser to MRDC, Thailand	Doc Data Sheet
Scientific Adviser Joint	1
Navy Scientific Adviser	Doc Data Sheet & Dist List
Scientific Adviser - Army	Doc Data Sheet & Dist List
Air Force Scientific Adviser	Doc Data Sheet & Dist List
Scientific Adviser to the DMO	Doc Data Sheet & Dist List
Information Sciences Laboratory	
Chief Command & Control Division	Doc Data Sheet
Research Leader Command Decision Environments Branch	1
Research Leader Information Enterprises Branch	1
Research Leader Joint Command Analysis Branch	Doc Data Sheet
Research Leader Intelligence Information Branch	Doc Data Sheet
Head Human Systems Integration	Doc Data Sheet
Head Information Exploitation	Doc Data Sheet
Head Effects-Based Modelling and Analysis	Doc Data Sheet
Head Distributed Enterprises	Doc Data Sheet
Head Joint Operations Analysis and Support	Doc Data Sheet
Head Command Concepts and Architectures	Doc Data Sheet
Head Command Process Integration and Analysis	Doc Data Sheet
Head Intelligence Analysis	Doc Data Sheet
Head Information Systems	1
Mark Burnett (Author)	**1 printed**
Pete Wooding (Author)	**1 printed**
Paul Prekop (Author)	**1 printed**
Publications and Publicity Officer, C2D/EOC2D	1 shared copy
DSTO Library and Archives	
Library Edinburgh	1 copy & Doc Data Sheet
Library Canberra	Doc Data Sheet
Defence Archives	1

Capability Development Group	
Director General Maritime Development	Doc Data Sheet
Director General Land Development	1
Director General Capability and Plans	Doc Data Sheet
Assistant Secretary Investment Analysis	Doc Data Sheet
Director Capability Plans and Programming	Doc Data Sheet
Director General Australian Defence Simulation Office	Doc Data Sheet
Chief Information Officer Group	
Director General Australian Defence Simulation Office	Doc Data Sheet
AS Information Strategy and Futures	Doc Data Sheet
Director General Information Services	Doc Data Sheet
Strategy Group	
Director General Military Strategy	Doc Data Sheet
Assistant Secretary Governance and Counter-Proliferation	Doc Data Sheet
Navy	
Maritime Operational Analysis Centre, Building 89/90 Garden Island Sydney NSW	Doc Data Sht & Dist List (shared)
Deputy Director (Operations)	
Deputy Director (Analysis)	
Director General Navy Capability, Performance and Plans, Navy Headquarters	Doc Data Sheet
Director General Navy Strategic Policy and Futures, Navy Headquarters	Doc Data Sheet
Air Force	
SO (Science) - Headquarters Air Combat Group, RAAF Base, Williamtown NSW 2314	Doc Data Sht & Exec Summ
Army	
ABCA National Standardisation Officer Land Warfare Development Sector, Puckapunyal	e-mailed Doc Data Sheet
SO (Science) - Land Headquarters (LHQ), Victoria Barracks NSW	Doc Data & Exec Summ
SO (Science), Deployable Joint Force Headquarters (DJFHQ) (L), Enoggera QLD	Doc Data Sheet
Joint Operations Command	
Director General Joint Operations	Doc Data Sheet
Chief of Staff Headquarters Joint Operations Command	Doc Data Sheet
SO Development ADF Warfare Centre	Doc Data Sheet
Director General Strategic Logistics	Doc Data Sheet
COS Australian Defence College	Doc Data Sheet

Intelligence and Security Group	
AS Concepts, Capability and Resources	1
DGSTA Defence Intelligence Organisation	**1 printed**
Manager, Information Centre, Defence Intelligence Organisation	1
Defence Materiel Organisation	
Deputy CEO	Doc Data Sheet
Head Aerospace Systems Division	Doc Data Sheet
Head Maritime Systems Division	Doc Data Sheet
Program Manager Air Warfare Destroyer	Doc Data Sheet
OTHER ORGANISATIONS	
National Library of Australia	1
NASA (Canberra)	1
UNIVERSITIES AND COLLEGES	
Australian Defence Force Academy	
Library	1
Head of Aerospace and Mechanical Engineering	1
Hargrave Library, Monash University	Doc Data Sheet

OUTSIDE AUSTRALIA

INTERNATIONAL DEFENCE INFORMATION CENTRES	
US Defense Technical Information Center	1
UK Dstl Knowledge Services	1
Canada Defence Research Directorate R&D Knowledge & Information Management (DRDKIM)	1
NZ Defence Information Centre	1
ABSTRACTING AND INFORMATION ORGANISATIONS	
Library, Chemical Abstracts Reference Service	1
Engineering Societies Library, US	1
Materials Information, Cambridge Scientific Abstracts, US	1
Documents Librarian, The Center for Research Libraries, US	1
SPARES	**5 printed**
Total number of copies: Printed: 10 PDF: 25	**35**

Page classification: UNCLASSIFIED

DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION
DOCUMENT CONTROL DATA

1. PRIVACY MARKING/CAVEAT (OF DOCUMENT)

2. TITLE Sense Making in the Australian Defence Organisation (ADO) Intelligence Community	3. SECURITY CLASSIFICATION (FOR UNCLASSIFIED REPORTS THAT ARE LIMITED RELEASE USE (L) NEXT TO DOCUMENT CLASSIFICATION) Document (U) Title (U) Abstract (U)
4. AUTHOR(S) Mark Burnett, Pete Wooding and Paul Prekop	5. CORPORATE AUTHOR DSTO Defence Science and Technology Organisation PO Box 1500 Edinburgh South Australia 5111 Australia

6a. DSTO NUMBER	6b. AR NUMBER	6c. TYPE OF REPORT	7. DOCUMENT DATE
DSTO-GD-0440	AR-013-446	General Document	July 2005

8. FILE NUMBER	9. TASK NUMBER	10. TASK SPONSOR	11. NO. OF PAGES	12. NO. OF REFERENCES
2005/1036540/1	STR 02/124	FASSP	30	26

13. URL on the World Wide Web	14. RELEASE AUTHORITY
http://www.dsto.defence.gov.au/corporate/reports/DSTO-GD-0440.pdf	Chief, Command and Control Division

15. SECONDARY RELEASE STATEMENT OF THIS DOCUMENT

Approved for public release

OVERSEAS ENQUIRIES OUTSIDE STATED LIMITATIONS SHOULD BE REFERRED THROUGH DOCUMENT EXCHANGE, PO BOX 1500, EDINBURGH, SA 5111

16. DELIBERATE ANNOUNCEMENT

No Limitations

17. CITATION IN OTHER DOCUMENTS Yes

18. DEFTEST DESCRIPTORS

Intelligence community
Intelligence analysis
Cognitive abilities
Cognitive processes

19. ABSTRACT

This paper discusses sense making, and its role in how intelligence analysts understand and interpret events. The inherent limitations in the way an analyst, based on organisational and personal perspectives, understands the world is described and points toward the need for meta-sense making techniques. Insights from complex systems theory and knowledge management can be used to understand how techniques from these areas can be applied in practice, and assist in mitigating some of the risks due to the cognitive limitations inherent in intelligence processes. The relation of an augmented capability for sensing and understanding to emerging whole-of-enterprise concepts such as Sense and Respond and UC2 is also sketched.

Page classification: UNCLASSIFIED